

1949

The use of data on soil and climate resources of Essex County, Massachusetts in agricultural instruction.

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THE USE OF DATA ON SOIL AND CLIMATE RESOURCES
OF ESSEX COUNTY, MASSACHUSETTS
IN AGRICULTURAL INSTRUCTION

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THE USE OF DATA ON SOIL AND CLIMATE RESOURCES
OF ESSEX COUNTY, MASSACHUSETTS
IN AGRICULTURAL INSTRUCTION

By

Alton G. Perkins

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MASSACHUSETTS

A problem presented in partial fulfillment of
the requirements for the Master
of Science Degree

University of Massachusetts

1949

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CHAPTER I

INTRODUCTION

CHAPTER I

THE INTRODUCTION

One of the important types of instruction offered by the Essex County Agricultural School to the students, farmers and growers of the County is the courses and information on the use of the soils and climate resources of Essex County. The author has been responsible for a large amount of this instruction and through the various channels of services offered by the school has made this instruction available to a large number of individuals. There has been much valuable research material published by the University Experiment Station at Amherst, the local County Extension Service, the Agricultural School staff, and soil experts from the Soil Conservation Service. The writer has had access to this material together with personal studies and investigations made in the County. This data has been of tremendous worth in organizing types of instruction dealing with the soil and climate resources of the County. Essex County has a wide variety of soil types, a varied topography and an assortment of weather conditions that has made it necessary for the grower to have great skill in order to produce successful crops and compete with growers from other parts of the State. Increasing publicity has been given in the newspapers and periodicals to the need of understanding and conserving the soil resources. The author has felt the trend of an increasing interest in the soil both from the

farmer and the general public. In view of these demands the writer has tried to make the soils courses practical and up to date by using the large amount of data available.

Statement of the Problem -- This problem involves the use of data on soil and climate resources for agricultural instruction purposes at the Essex County Agricultural School.

Need for this Study -- The author has been the instructor of soil courses at the Essex County Agricultural School for a number of years and has also been in charge of the soils laboratory which involves hundreds of soil tests and the analysis of soil and crop problems. There has been demands by garden clubs and various industrial organizations for soils and fertilizer lessons so that their members might improve their garden techniques. A telephone call, a letter, or a personal visit to the school for information on soil and crop problems is a common occurrence.

The problems of vegetable gardeners, orchardists, and dairy farmers are intricate and demand an accurate knowledge of the soil and climate resources in order to give proper instruction.

In order to set up soils courses to make them interesting and profitable there is need of accurate and scientific information on the soil and climate resources of Essex County.

Economic Importance -- In a recent article on "Agriculture in 1950" by Francis Smith, County Agent for Essex County,² some interesting economic statements are made regarding the future of Essex County agriculture. The question is asked, "What are some of the changes or adjustments a farmer in Essex County can make that will have some effect on his net income?" Mr. Smith states "that since the farmer can influence price to only a limited extent, there are various factors which he can change and which do influence the net income." A critical analysis of this problem by David Rozman, Research Economic Professor in the Massachusetts Experiment Station³ shows that more than half of the commercial farmers in this State fail to meet the desirable requirements of income for farm families." Mr. Smith says this is true of Essex County, also. Professor Rozman further states "that the greatest need is for the organization of these farms which are weak in some of these factors for making a high income into efficient economic family units capable of providing an adequate level of living under modern conditions. One of the best methods of rebuilding such farms is the rebuilding of land resources, which are the basis of farm operations."

(2) Smith C. Francis, "Agriculture in 1950"
Essex County Extension Service - 1949

(3) Rozman, David, "Interrelationship of Land Uses in Rural Massachusetts" - University of Massachusetts Experiment Station - 1941

The County Agent claims "that large areas in Essex County are available and of suitable fertility to warrant clearing and developing. Classification of soil and field investigations indicate that improvement of good soil types is justified by costs and resulting benefits. Such areas may make possible replacement of poor land now in use and permit the poor land to be set out to red pine or some similar types of trees."

In a study of Agricultural Finance in Massachusetts made by the University of Massachusetts Experiment Station a rather important statement was made under the heading, "Factors Affecting a Farmer's Ability to Repay Loans". Thus, it appears that, as far as ability to repay a loan is considered, the most important factors are the adaptation of the type of farming to the area, quality of the natural characteristics of the farm (soil, topography, etc.)".¹

Studies of Essex County weather made by the weather station at the school and the local county extension service indicate that frost hazards, drought periods and uncertain weather conditions during the growing season cause large losses in crop production. It is important to have some knowledge of weather factors in order to devise methods of overcoming these forces.

(1) Sargent, Russell, A.H. Lindsey, "Agricultural Finance in Massachusetts" - University of Massachusetts Experiment Station, Bulletin 405 - June 1943.

Types of Individuals Involved in the Instructional Program -- There are many different groups and types of individuals that receive instruction from the soils and climate courses during the year. The regular day students who are enrolled at the school for the two, three or four year agricultural courses receive this instruction in their science course. There are about two hundred of this type of student. The veterans studying under the G.I. Bill of Rights and the adults in the Short Unit Course receive intensive training in soils and climate resource material. Prospective farm buyers, farmers with soil and crop problems and backyard gardeners receive instruction on their soil and crop problems. Local garden clubs receive instruction in certain phases of soil work whenever there is a demand.

Procedures Used in This Study -- In order to teach practical courses in soils and climate resources in a vocational school it is necessary to have a comprehensive and accurate knowledge of data on soil types, rainfall, frost and community resources of Essex County. The author has been collecting data of this type for several years from every source available. In order to get first hand experience the writer has made many field trips to different parts of the county to study soil types, crop problems and other factors that involve the physical resources of the county. Questionnaires were sent out to a group of students who had completed the Short Unit Course in soils and fertilizers to find their reaction to the course and

type of instruction given in this set-up.

This valuable data has been intergrated into the courses given at the school and has made them very profitable to students taking the soils courses.

CHAPTER II

TYPES AND SOURCES OF DATA

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TYPES AND SOURCES OF DATA

Data on Soils -- Several valuable sources of data on soils have been used in this study. A soil survey of Essex County, Massachusetts by W. J. Latimer of the United States Department of Agriculture and W. O. Lamphear, Massachusetts Department of Agriculture was used to obtain detailed characteristics of Essex County soil types and their adaptation for agricultural crops. A recent study made by the Essex County Soil Conservation District on the soil characteristics supplied up-to-date information on drainage, surface features, inherent fertility and crop adaptation of Essex County soils. A bulletin on "The National Land Types of Essex County, Massachusetts" by Dr. Arthur Beaumont of the State Soil Conservation Service, has provided an excellent, concise set-up, of the soils of Essex County by grouping them according to their origin, topographical features, soil characteristics, adaptation and erosion possibilities. Studies of economic importance were made by the Essex County Extension Service under the direction of County Agent Francis Smith. This work involved a detailed study made on the successful commercial farms engaged in the various agricultural enterprises in the County. Valuable correlations were made available on how successful crops depend on the selection of the proper soil types.

Data on Rainfall -- The Weather Bureau operated by Harold Mostrom, Director of the Essex County Agricultural School, has supplied very valuable data on rainfall for a period of over twenty-five years. Figures have been available on the daily precipitation of rain and snow for this period. Also, the total precipitation of the year including information on comparisons with past years has been available for this study.

The Essex County Extension Service made a very helpful and important study on the weather of Essex County which supplied data on the effect of the rainfall of a ten year period on the agriculture of the county. Rainfall statistics kept by government officials at Lawrence and Haverhill were used in this study.

Data on Frost -- The Weather Bureau of the school supplied frost dates for a period of ten years. Official records kept at Haverhill for a period of thirty years and at Lawrence for thirty-eight years provided accurate records on the occurrence of frost in an important area of the county. Also, farmers in the various agricultural areas of the county supplied important frost information as it occurred in their area. The Essex County Extension Service in a study on weather in Essex County has put this frost data together and made available some valuable data on the effect of the length of growing season on agricultural crops raised in the county. Information on the earliest and latest frost dates occurring in the most im-

portant agricultural towns and cities of the county and the average length of the growing seasons in these areas furnished most helpful material on frost.

Data on Community Resources -- A very comprehensive set of reports called "The Preliminary Reports on Rural Policy for the Towns and Cities of Essex County". A committee representing the various rural interests of the town and city was appointed by the Essex County Extension Service. These individuals were supplied with a set of objectives and in cooperation with the county and state extension services prepared a very fine report dealing with the resources, opportunities and limitations of the agriculture of each area. The description of physical resources of each town and city has been of special value in this problem. This description supplied facts on the location, climate, topography, water bodies, soils and land uses, which was most valuable in making a study of the resources of each town and city in Essex County.

CHAPTER III

CLASSES, COURSES AND UNITS IN WHICH
THE DATA WAS USED

CHAPTER III

CLASSES, COURSES AND UNITS IN WHICH DATA WAS USED

Day School Students -- The regular agricultural day students are required to take a related science course each year that they are enrolled at the school. In these science courses a student receives instruction in soils, climate resources and related problems each year that he attends the school. An idea of how this type of instruction operates will follow.

Freshman Related Science Course

Units on Soil

Problem: Selecting a Soil for Crops

- Topics:
1. Use of a Soil Survey
 2. Brief Study of Essex County Soils
 3. Selecting Soils Suitable for Crops

Problem: How Soils are Formed

- Topics:
1. Origin of Soils
 2. Formation of Essex County Soils
 3. Effect of the Glacier on Essex County Soils

Problem: Classification of Soils

- Topics:
1. Composition of Soil
 2. How Soils are Classified
 3. Use of Each Type in Agriculture

Problem: Importance of Chemical Resources of Soil

- Topics:
1. Taking Soil Samples
 2. Testing for Available Chemicals
 3. Interpretation of Tests

Problem: Importance of Physical Resources of Soil

- Topics:
1. Value of the Organic Content
 2. Testing for Organic Matter
 3. Methods of Applying Organic Matter to the Soil

Problem: Applying Plant Food to the Soil

- Topics:
1. Composition of Fertilizers
 2. Adapting Fertilizers to Crops
 3. Methods of Applying Fertilizers

Problem: Correcting Soil Acidity

- Topics:
1. How Soils Became Acid
 2. Use of Lime in Soils
 3. Methods of Applying Lime

Sophomore Related Science

Units on Soils

Problem: Relation of Soil to Crops

- Topics:
1. Crop Requirements
 2. Improving Fertility of Soils
 3. Effect of Soil Nutrients on Crops

Problem: Improving the Soil Environment

- Topics:
1. Soil Reaction
 2. pH Requirements of Crops
 3. Correcting Soil Reaction

Junior Related Science

Weather Units

Problem: To Find How Frost Acts

- Topics: 1. Science of Frost
2. Conditions Under Which Frost Occurs
3. Type of Damage Done

Problem: The Effect of Frost on Crops

- Topics: 1. Analyzing Frost Data
2. Preparing Frost Chart
3. Effect of Frost on Length of Growing Season in Essex County

Senior Related Science

Unit on Soils

Problem: Appraising a Farm Soil

- Topics: 1. Factors Involved in Appraisal
2. Using a Score Card on Soils
3. Value of Making an Appraisal

Problem: Mapping a Farm

- Topics: 1. Mapping Out Soil Types on School Farm
2. Adapting Crops to Soil Types
3. Planning a Fertilizer Program Based on Results Found

Problem: Making a Field Study of a Soil

- Topics: 1. Analyzing a Soil Type in the Field
2. Use of Soil Auger
3. Laboratory Tests as an Aid to Soil Study

Problem: The Chemical Make-up of the Soil

- Topics: 1. The Meaning of pH
2. The Relation of Availability of Plant Nutrients to Soil Reaction

3. Overcoming Plant Deficiencies

Problem: The Efficient Use of Fertilizers in the Soil

- Topics:
1. Types of Chemicals Available
 2. Reaction of Chemicals in Soil
 3. Proper Methods of Applying Fertilizers

Senior Related Science

Weather Units

Problem: The Relation of Weather to Agriculture

- Topics:
1. What is Weather
 2. Effect of Weather on Agriculture
 3. Essex County Weather Conditions

Problem: Forecasting Weather

- Topics:
1. Use of Weather Instruments
 2. How Weather is Forecast
 3. Use of Weather Maps

Problem: Interpreting Weather Data

- Topics:
1. Meaning of Weather Terms
 2. Working Out Data from Statistics
 3. Interpreting Meaning of Results for Essex County

These units on soils and weather are made as practical as possible. The students are taken on field trips, and many devices are used to help the student work out these problems.

Evening School Students -- The veterans who are studying under the G. I. Bill of Rights program and the Short Unit Course students are included under the evening school program. Most of the veterans are only enrolled for a year or two and are given an intensive soils course that includes problems in soils, climate resources, crop requirements, plant growth factors and other related types of materials.

The Short Unit Course in soils and fertilizers is offered to adults in the county who can profit by the instruction. This is a short twelve weeks course that is set-up to give practical instruction on vital soil, climate and crop problems that such individuals would be apt to meet in their work. Each student must have a project so that he can work out some of the principles taught in the course. The instructor makes visits to the projects to assist the student with his problems in the field.

Service Calls -- Each year many individuals in need of help with soil and crop problems contact the school for personal help. The author gives instruction to these individuals on an unassembled basis. This instruction is often given in the soils laboratory and whenever there is a need a visit is made to the farm or garden to further instruct and guide the individual. A prospective farm purchaser may receive instruction at the school on the essentials involved in selecting a farm which is followed by a visit to the farm by the instructor. A complete appraisal is made

of the farm and a report is submitted with an analysis of the findings. The prospect can then decide with these facts and other information he has gathered whether this farm meets his requirements.

Telephone calls and letters are received from individuals seeking help with problems. The author has spent much time making investigations and doing certain research work in order to properly instruct these individuals. These calls may require further instruction by a visit to the place where the problem is located.

CHAPTER IV

USE OF DATA IN CLASS TEACHING

CHAPTER IV

USE OF DATA IN CLASS TEACHING

Typical Soils Lesson -- A very important soils lesson is taught during the fall term of the senior year in the agricultural day students science course. The problem is, "How to Select a Farm Soil in Essex County". In order to have the students acquainted with the soil types of Essex County a brief study of some of the important farm soils is made in outline form using the Soil Survey of Essex County and The Natural Land Types of Essex County as references. After this study is made each student is asked to select five soils best suited for each type of farming. Then a map is to be prepared showing where these soils are located. If the student desires to purchase a farm he can check up the soil type and appraise the farm himself with the knowledge he has received.

The forms used in this study are shown on the following pages:

SOIL SURVEY OF ESSEX COUNTY SOILS

Soil type

Merrimac Sandy Loam

Topography

The surface of this soil is prevailing level broken only by low swells in places.

Derivative

This soil is derived from glacial outwash material laid down by streams emerging from the glacier along the valleys or in shallow lakes.

Description of top-soil

In cultivated areas the top-soil is dark brown mellow sandy loam 3 - 10 inches thick.

Description of sub-soil

The sub-soil is yellowish-brown fairly firm but mellow sandy loam grading at a depth of 13 or 20 inches, into light yellowish-brown sandy loam less compact.

Characteristics

Well drained to drouthy - non-stony - early soil - a very level soil.

Adaptation

Truck crops, corn, alfalfa, clovers, grasses.

Distribution and importance

Largest areas found in towns of Topsfield, Rowley, Merrimac, Georgetown, Boxford and Lynnfield. This is a fairly important soil.

A Study of Soil Types and Their Adaptation

Merrimac Fine Sandy Loam

ESSEX COUNTY



Distribution of Merrimac Fine Sandy Loam

This soil type is known as a Merrimac Fine Sandy Loam and is perhaps our most level soil. The largest areas are located in the southern part of the county.

SOIL SURVEY OF ESSEX COUNTY SOILS

Soil Type

Gloucester Loam

Topography

This soil occurs on hilltops and smooth ridges.

Derivative

This soil is derived from the weathering in place of glacial till composed largely of granite and gneiss material with a small mixture of achist and other metamorphic rocks.

Description of Top-soil

In cultivated areas the soil, to a depth of 6 - 8 inches is dark-brown light loam, which rests on a yellowish-brown sub-soil.

Description of Sub-soil

Under the 6 - 8 inches top-soil there is a yellowish-brown fixable medium-textured loam sub-soil grading down into a yellow compact slightly compact loam.

Characteristics

Non-stony - inherent fertility is high - well drained.

Adaptation

Truck crops, corn

Orchard, alfalfa, clovers, grasses, which makes it a very fine dairy farm soil.

Distribution and Importance

Gloucester Loam is farmed as well as, if not better than, any other soil in the county that is used for general farming. This soil occurs in Northwestern part of county.

A Study of Soil Types and Their Adaptations

Gloucester Loam

ESSEX COUNTY



Adapted for:

Orcharding
Dairying
General Farming

Distribution of Gloucester Loam

A very important type of farm soil in Essex County.

Typical Frost Lesson -- In the Science Course of the Junior year the students are given instruction on some of the limiting factors that a grower faces in raising crops. One of the important limiting factors is frost. A lesson is set-up on this hazard to show the student "The Effect of Frost on the Growing Season at Hathorne". In making this study the student becomes conscious of how a community can be effected by frost. The student is asked to read over the data given him on actual records kept by the school weather station for a period of fifteen years. With this information he is asked to prepare a graphic chart with a key so that information may be had at a glance on the last heavy spring frost and the first killing frost of fall, the last light spring frost, the first light fall frost, the additional growing season for less sensitive crops, the growing season for frost sensitive crops, and the plants rest period.

This type of study gives the student a real and accurate picture of what the limitations are in one area of Essex County. It awakens a student to the limiting factors in his own community where he can easily transfer this knowledge.

The data furnished the student and an example of how a graphic chart is made is illustrated in the following examples:

"The Effect of Frost on the Growing Season at Hathorne"

The following table provides the information required in the preparation of a graphic chart.

Year	SPRING		FALL	
	Last Heavy	Last Light	First Light	First Killing
1926	May 28	June 4	Sept. 14	Oct. 19
1927	May 8	June 4	Oct. 10	Oct. 11
1928	May 13	May 15	Sept. 24	Oct. 15
1929	May 23	June 3	Sept. 23	Oct. 6
1930	May 11	June 1	Sept. 11	Oct. 1
1931	May 5	May 18	Sept. 30	Oct. 10
1932	May 24	June 8	Sept. 19	Oct. 14
1933	May 11	June 2	Sept. 12	Oct. 21
1934	May 19	June 8	Aug. 31	Oct. 2
1935	May 5	May 24	Sept. 13	Oct. 3
1936	May 16	May 22	Sept. 26	Oct. 4
1937	May 16	May 16	Oct. 3	Oct. 9
1938	No Record		No Record	
1939	May 16	May 16	Sept. 19	Oct. 16
1940	April 29	May 18	Sept. 27	Oct. 17
1941	April 23	May 31	Sept. 20	Sept. 30

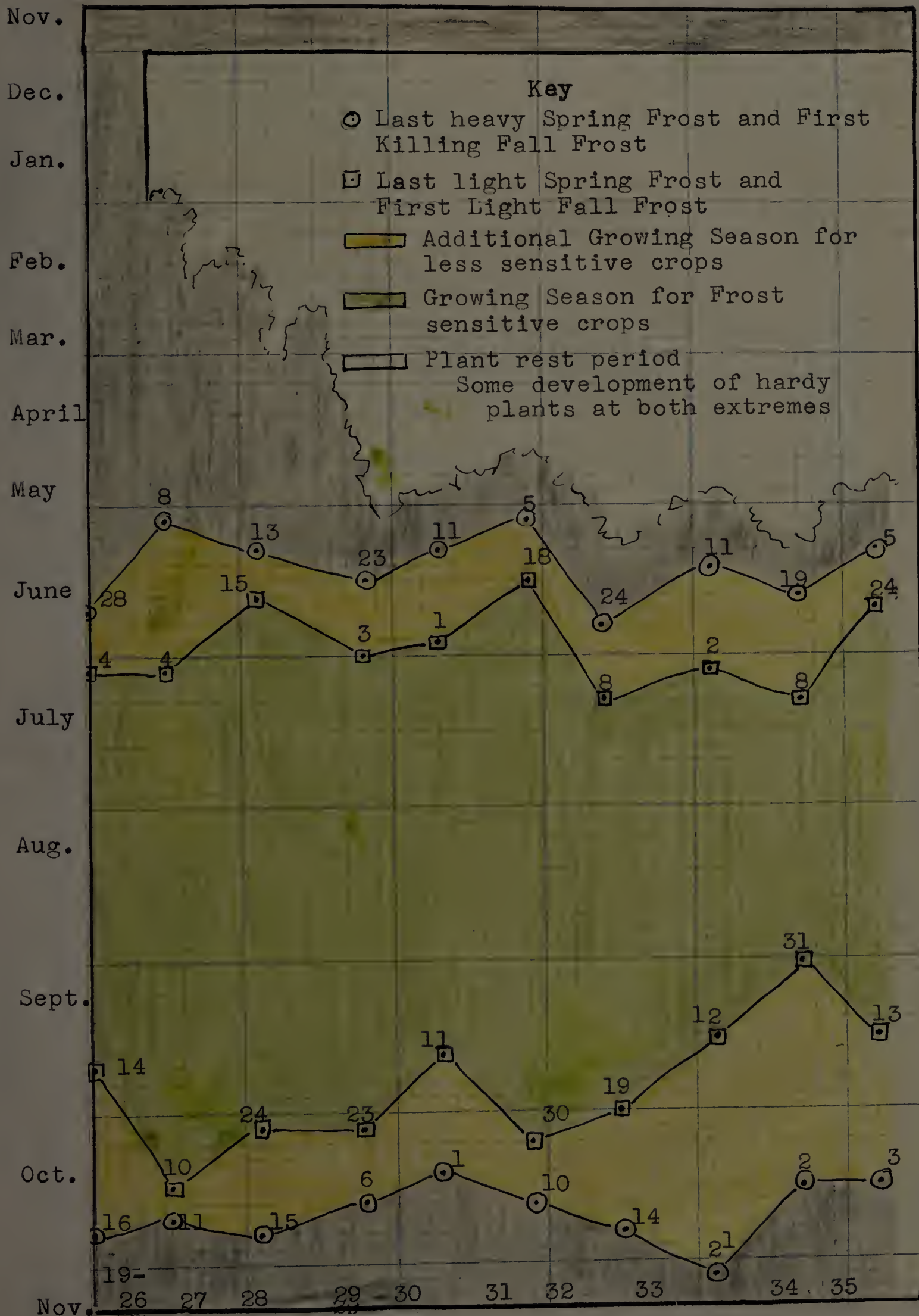
In making the chart on graph paper:

1. Run the months on the left, and the years on the bottom.
2. Represent killing frost dates in circles.
3. Connect killing frost dates with dotted lines.
4. Represent light frost dates in squares.
5. Connect light frost dates with an unbroken line.
6. Color in the three zones namely:
 - (a) Growing season for sensitive plants
 - (b) Growing season for less sensitive plants
 - (c) Plant rest period
7. Provide a key for symbols and colors.

INFORMATION TO OBTAIN

1. The average date of the last killing frost in the spring.
2. The average date of the last light frost in the spring.
3. Last safe planting date four years out of five for frost sensitive plants.
4. Last safe planting date four years out of five for less sensitive plants.
5. Average date of the first light frost in the fall.
6. Average date of the first killing frost in the fall.
7. Average length of the growing period for frost sensitive plants.
8. Average length of the growing period for less sensitive plants.

The Effect of Frosts on the Growing Season at Hathorne



Typical Rainfall Lesson -- During the Senior year a unit on weather is given in the science course. The amount of rainfall and its distribution are important factors in growing crops. A lesson on rainfall is included in these weather studies. The student is asked to figure out the amounts of precipitation occurring in certain months based on weather statistics kept at the school weather bureau. In this study he sees whether the precipitation is above or below average and what its effect could be on the crops during the growing season of any given month.

The weather summary sheet for January, 1949 found on page is used as an example of how this study is made.

Rainfall and Weather Lesson -- During the Senior year a unit on rainfall and weather is given in the science course. It is the purpose of this lesson to make the student conscious of weather data and its value in agriculture. The student is asked to work out the answers to questions listed on a mimeograph sheet. The statistics were compiled by Mr. Harold Mstrom of the school weather bureau. Emphasis is given to the amount of precipitation in the various months of the year to see whether the amount is normal. The effect of rainfall on crops is made clear in this study. Other weather factors are studied also, including temperature, relative humidity, and the amount of sunshine.

A lesson using local weather data is illustrated by the problem on page 32 with questions and answers.

WEATHER SUMMARY - JANUARY, 1949

DATE	MAX. T.	MIN. T.	Avg. T.	Avg. REL. HUM.	PREC.	SUN
1	33	30	31.5	90	.01	0
2	38	26	32.0	77	.02	3
3	39	22	30.5	73	0	4
4	40	30	35.0	82	T	4
5	50	30	40.0	98	.27	0
6	57	30	43.5	86	.65	5
7	47	33	40.0	74	0	4½
8	54	34	44.0	66	0	9
9	46	34	40.0	83	0	3
10	45	39	42.0	84	0	0
11	42	18	30.0	58	0	5
12	39	13	25.5	70	0	2½
13	35	26	30.5	61	0	8½
14	38	32	35.0	69	0	9½
15	25	16	20.5	58	0	9½
16	52	20	36.0	73	T	3½
17	51	41	46.0	80	T	0
18	38	32	35.0	83	T	0
19	60	38	49.0	93	.03	0
20	37	20	28.5	46	0	9½
21	32	16	24.0	87(3" snow)	.30	0
22	44	24	34.0	78(1" snow)	.75	6
23	35	24	29.5	75	0	7
24	38	28	33.0	98(½" snow)	.10	0
25	32	24	28.0	87	.01	0
26	28	19	23.5	89(3½" snow)	.35	0
27	26	18	21.0	81(2½" snow)	.26	0
28	40	22	31.0	95(½" snow)	.30	0
29	42	20	31.0	67	0	9½
30	27	12	19.5	62	0	9½
31	35	16	25.5	87	.93	0

FACTS TO BE DETERMINED

1. Max. T. and date of occurrence.
2. Min. T. and date of occurrence.
3. Ave. daily Max. T. Ave. daily Min. T. Ave. daily T.
4. Greatest daily range in T. and date of occurrence.
5. Least daily range in T. and date of occurrence.
6. No. days T. dropped to 32° or below.
7. No. days T. did not rise above 32°.
8. Total precipitation for the month.
9. Was this an excess or deficiency and how much?
(20 yr. ave. = 3.80")
10. No. days on which precipitation of at least .01".
11. Total inches of snowfall for month.
12. Average daily relative humidity.
13. No. clear days (Sun 70% of time or more).
14. No. partly cloudy days.
15. No. cloudy days (Sun less than 30% of time).
16. N.B. 1-7, 9 hrs: 8-24, 9½ hrs: 25-31, 10 hrs.
16. Total hours and percent of sunshine.
(Total possible - 294 hours)

Problem: Work out a cross section study of the weather for the month of January, 1949. Use the weather summary sheet and work out the answers.

Facts to be Determined

1. Maximum temperature and date of occurrence?
ANS. 60°F on the 19th day of the month.
2. Minimum temperature and date of occurrence?
ANS. 12°F on the 30th day of the month.
3. Average daily maximum temperature?
ANS. 40.1°F
Average daily minimum temperature?
ANS. 25.3°F
Average daily temperature?
ANS. 32.7°F
4. Greatest daily range in temperature and date of occurrence?
ANS. 32°F on 16th
5. Least daily range in temperature and date of occurrence?
ANS. 30°F on 1st
6. No. days temperature dropped to 32° or below?
ANS. 25 days
7. No. days temperature did not rise above 32°F ?
ANS. 6 days
8. Total precipitation for the month?
ANS. 3.98 inches
9. Was this an excess or deficiency and how much?
(20 year ave. = 3.80 inches)
ANS. Excess .18 inches

10. No. of days on which precipitation of at least
.01 inches?

ANS. 13 days

11. Total inches of snowfall for month?

ANS. 11 inches

12. Average relative humidity?

ANS. 77.7

13. No. clear days (sun 70% of time or more)?

ANS. 8 days

14. No. partly cloudy days?

ANS. 9 days

15. No. cloudy days (sun less than 30% of time)?

ANS. 14 days

16. Total hours and percent of sunshine - total possible
294 hours?

ANS. 112.5 hours 38.3%

Typical Community Resource Lesson -- Every agricultural student needs the background of a study in the resources of his own community. A lesson on the community resources of a town or city is given in the science course during the freshman year. This study deals with the physical resources and provides data on the climate, the topography, relief and drainage, water bodies, and soils. The student is asked to work out these studies under an outline that will serve as a guide. With this knowledge a student should know the possibilities of agricultural pursuits more definitely and should understand the possibilities as well as the limitations of certain types of agriculture. Aware of this, he should be better equipped to carry on a successful type of agriculture in his community.

An example of how this study works out is worked out as follows:

A Study in the Use of Resources of Essex County

Physical

Town

Topsfield

I. Location

Topsfield is located approximately in the center of Essex County. On the north it is bordered by the town of Ipswich, on the west by the towns of Boxford and Middleton, on the east by the towns of Hamilton

and Wenham, and on the south by the towns of Danvers and Middleton.

II. Climate

The climate similar to other inland towns in the county. Certain weather records kept by farmers in the town reveal that the latest frost in the spring usually occurs around April 25th with the earliest frost in the fall coming about October 5th. This gives a growing season of approximately 163 days. Weather records kept for a twelve year period at the Essex County Agricultural School shows an average of 40.30 inches of precipitation. The wettest year showed the amount of precipitation of 48.28 inches and the driest year has been recorded as 33.09 inches. The averages for the months in the growing season are as follows:

March	4.01 inches
April	3.07 inches
May	2.41 inches
June	3.50 inches
July	2.44 inches
August	3.44 inches
September	3.99 inches

From these figures it can be observed that danger of drought is eminent in May and July, two critical months in the life of the crops.

III. Topography

The greater part of Topsfield is characterized by a rolling terrain. This is especially true for the central and south central sections of the town and on either side of the Newburyport Turnpike which runs in a north and south direction. The slopes are gradual. Approximately four-fifths of the land area is at sea level to 100 feet above sea level, the remaining fifth ranging between 100 and 200 feet above the sea. Four points in the town reach an elevation of more than 200 feet, and the highest is but 260 feet in height. The northeastern corner of the town is rather level. The flattest land lies along the low and marshy Ipswich River.

IV. Water Bodies

The total water area in Topsfield amounts to thirty-six acres. Although numerous ponds and brooks are found throughout the town, for the most part, they are quite small. The largest body of water is the Ipswich River which enters from Middleton on the western boundary.

V. Soils

The total area in Topsfield is 8,228 acres. The University of Massachusetts Agricultural Experiment Station has classified the soils in Essex County into three major groups according to their

adaptability for agricultural purposes. The figures for Topsfield are as follows:

	<u>Approximate acres</u>	<u>Percent</u>
Good adaptability	2,223	27.0
Limited adaptability	4,608	56.0
Unsuitable	1,397	17.0
Total	8,228	100.0

Soils with good adaptability include the loams, fine sandy loams, sandy loams and some gravelly loams. They have mostly level or gently rolling surfaces, comparatively few stones, are easy to cultivate, and are neither too wet or too dry for some sort of agricultural usage.

Soils with limited adaptability have a rougher and more uneven topography with steeper slopes. They contain more stones, are more difficult to cultivate, and are either so wet or dry that success in agriculture is more difficult and hazardous to attain, but not impossible.

Woodbridge loam, a soil with excellent moisture-holding capacity and in which drainage is well established except in seepy spots on the hillsides is the predominating soil type and is located on drumlins in the central and south central parts of the town. Essex fine sandy loam is found at the foot of the drumlin areas and is similar to the woodbridge loam. Patches of Merrimac fine sandy loam, an excellent market garden soil, are found

in the northeastern sections of the town. Berri-
mac sandy loam is well drained and is inclined to
be excessive, occupies an area about the size of
woodbridge loam. The gravelly loams are in the
minority, but peat and muck are quite extensive,
especially along the Ipswich River.

On the whole, because of the rolling terrain and
good water-holding capacity, the soils are class-
ed as having good adaptability and are best suit-
ed to dairying.

CHAPTER V

USE OF DATA DURING SUPERVISION OF
SUMMER PROJECT PROGRAM

CHAPTER V

USE OF DATA DURING SUPERVISION OF THE SUMMER PROJECT PROGRAM

The Summer Science Lesson -- The day students in the regular agricultural courses at the school are released from the school about April first of each year for a six month work program. They are placed on farms, estates, greenhouses and in other agricultural enterprises where they have rich experiences with soils and crop problems during the growing season.

In order to take full advantage of this work program the school has maintained a summer science program for over twenty-five years.

It is the aim of this science program to provide instructional material of a scientific nature that will be centered around the students project. It seeks to give him the scientific approach, develop his observational powers and to help him tie in his science studies with his practical work experiences.

An example of how a lesson is taught on the job will make it clearer. The lesson can be taught by an agricultural or science instructor depending which one is visiting the student.

A typical lesson taught early in the season might be "When will you set out tender plants?" A sheet similar to the one on the next page is given to the student. It is set-up in concise and interesting manner. The student is confronted with this very problem so the stage is set

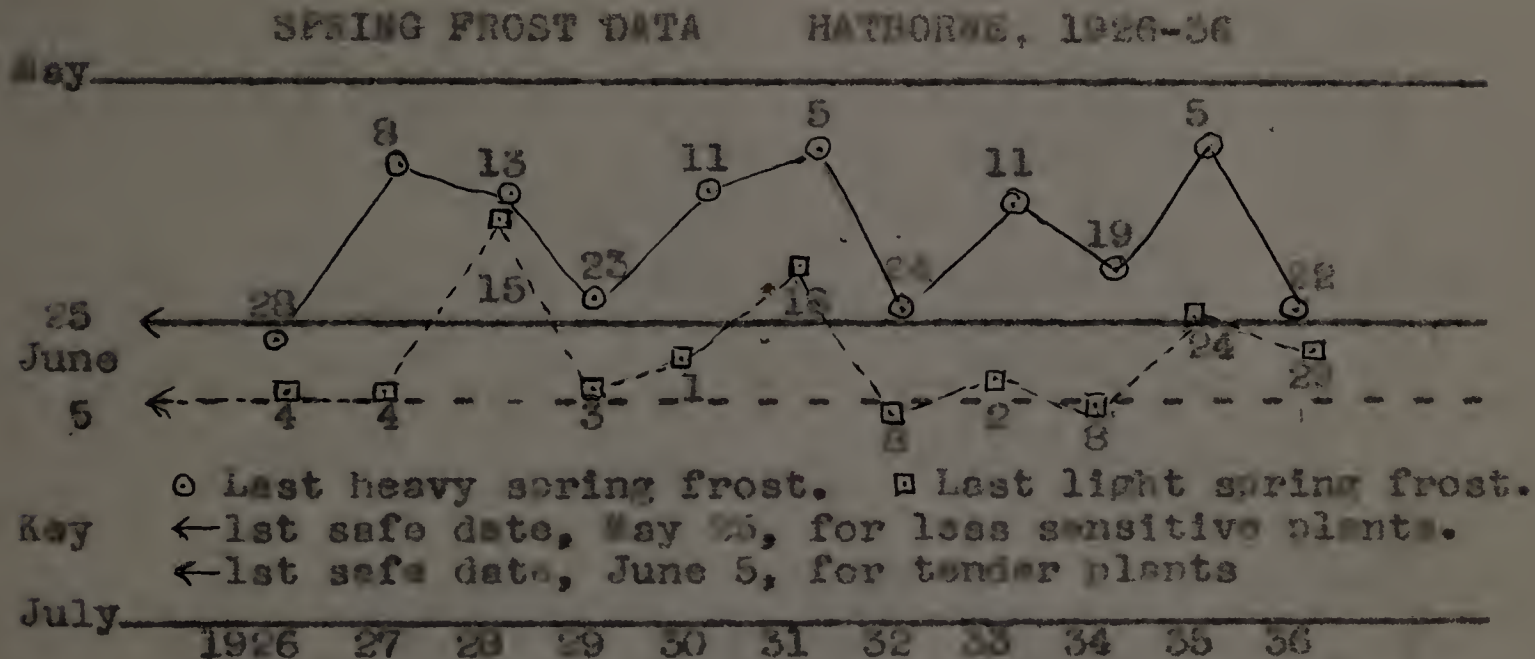
WHEN

WILL YOU SET OUT TENDER PLANTS?

The figure below presents frost dates taken at the school.

You cannot use this information, as frost is a local problem.

But you can accumulate similar records on your own farm.



WHAT TO DO

1. Use a min.-max. thermometer.
2. Observe weather conditions.
3. Keep and use frost records.
3. Listen in on radio reports

Ways to Prevent Frost Damage

Plant or set out plants on a safe date. (Discuss with pro-
 Use of hot caps, special coverings, etc. with instructor).
 Use of oil pots, rubber tires, etc., on dangerous nights.
 Water frosted plants early in the morning.

DO YOU KNOW

- The plants which are hardy? very sensitive? less sensitive to frost?
- The appearance of frost damage on strawberries, apples, corn and beans?
- Why frosts are likely to occur on clear nights? on calm nights?
- Whether frosts occur more frequently on high or low land? Why?
- The safe date for planting each kind of seed?
- What afternoon weather conditions are indicative of a possible frost?

for a profitable lesson. The instructor points out how the frost has occurred in Hathorne and uses this data as a basis for showing the student how necessary it is to make observations and keep records. The discussion of the methods used in obtaining information on frost, the ways to prevent frost damage, and other important data on frost is used in the frost lesson with the student. The instructor leaves the lesson plan with the boy and asks him to keep it in his notebook where records on frost will be kept and questions answered. On the next visit the instructor will check up to see how the student has progressed and will assist him with any questions he might have on the subject.

A Project Visit - - A student of the Agricultural School is under the supervision of the school for twelve months. During the project season the student is visited by an instructor to see that instruction is given on important phases of his work. The author has carried on this plan of instruction with adult students who had received instruction in the soils and fertilizers course during the winter months.

The plan is to visit the student on his job or at his home. In the classroom he has made some definite plans that he intends to carry out on his project.

A visit is made to the project to see how well the student is carrying out his plans. Sample copies of the reports and typical visits are shown on page 43.

PROJECT REPORT FORM USED IN THE FIELD

KIND OF PROJECT Date: Oct. 13, 1948

Day ☐ Unit ☒ Ext. ☐

Pupil's Interest	Pupil as Worker	Pupil as Manager	Records Accounts	Weekly Reports	Empl. Rating	Project Progress
A	A	OK				A

Project work, equipment, management; Specific farm work; Supplementary farm practices; etc.

1. 1800 sq. feet of vegetable garden
2. with the following crops;
3. Tomatoes, Peas, Celery,
4. Carrots, Lettuce, Onions,
5. Cabbage

Comments, Suggestions or Directions:

Horse manure is OK to use. I would suggest a 5-10-5 fertilizer as a side dressing for corn and Swiss Chard. Sow rye to protect your soil and add organic matter. This would be a good time to apply your superphosphate and muriate of Potash.

Related Science, References Suggested:

Note the rate of plant growth - color of leaves - date of maturity etc.

ESSEX COUNTY AGRICULTURAL SCHOOL

copy received by:

KIND OF PROJECT Date: June 27, 1948

Day ☐ Unit ☒ Ext. ☐

Pupil's Interest	Pupil as Worker	Pupil as Manager	Records Accounts	Weekly Reports	Empl. Rating	Project Progress
A	A	A			OK	OK

Project work, equipment, management; Specific farm work; Supplementary farm practices; etc.

1. General farm work, cattle, crops, etc.
3. 400 acres in farm
4. Improvement of soil for crops
5. is special problem

Comments, Suggestions or Directions:

Took several soil samples personally to help with soil problems.
#1 sample low swamp land
#2 squash field
#3 field where oats are not doing well
#4 slope where corn is growing will report later on results

Related Science, References Suggested:

Study your soil types from soil survey of Essex County.

ESSEX COUNTY AGRICULTURAL SCHOOL

copy received by:

CHAPTER VI

USE OF DATA IN ANSWERING SERVICE CALLS

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USE OF DATA IN ANSWERING SERVICE CALLS

Typical Types of Service Calls -- A service call may present any number of problems and involve several contacts before the solution is completed. A typical case is that of an individual who came to the school to receive help on a problem as to whether he should buy a farm that was for sale in Merrimac, Massachusetts. The individual was employed in industry and wanted a farm which he could make pay for itself while he still was employed. When he reached retirement age he would like to go in for a more intensive farming program. The farm was priced at \$9000 and he felt he should look into the proposition carefully before he went ahead with the purchase. The writer talked the proposition over carefully with this individual at the school and decided to make a visit to the farm with him. In company with this man the author made a careful survey of the farm, taking notes, making suggestions and answering questions as we walked over the farm. Soil samples were taken from the different fields, the soil types were checked with the soil survey report of Essex County. After testing the soil samples and making a detailed study of the farm the author prepared a report and sent a copy to the individual. This report plus the personal instruction given in the two conferences with the buyer gave him some basis on which to make a decision as to whether this farm met his requirement. The type of report sent this individual is illustrated on page 46.

Farm located on Center Street, Merrimac, Mass.

Prevailing Soil Type - Merrimac Sandy Loam

Adapted for: 1. Poultry

2. Market Garden Crops such as: Asparagus, squash, beets, beans, spinach, parsnips, carrots, turnips and tomatoes.

3. Small fruits: raspberries, strawberries, blueberries (in certain sections of the farm).

4. Field Crops: corn, alfalfa, oats, rye, millett, potatoes.

5. Nursery Stock

6. Pine Trees

Suggested practices to build soil fertility:

This soil type is usually lacking in organic matter and is apt to be acid unless recent applications of lime have been made. I suggest that you take one or two fields each year and build them up for future crops when you decide on your plans.

Apply one ton of a magnesium limestone (12 - 17% magnesium) per acre. Plow the field this fall and apply lime. Harrow the lime into the top soil and sow down to winter rye. If you have manure available this could be plowed under before sowing rye. The winter type should be plowed under in the spring. A crop of buckwheat can be seeded after the rye has been plowed under. Another crop of rye can be seeded after the buckwheat has been plowed under. These practices should build up your soil

in a year or two and you will get better results with any crop you might plant.

Before a crop is planted it would be well to apply 1000 - 1500 lbs. of a 5-10-10 fertilizer per acre. If you have manure available you could use less fertilizer.

I would also suggest that 500 lbs. of superphosphate and 150 lbs. of muriate of potash be applied after the soil has been plowed.

Land Use

Suggested crops for different fields:

Field #1: Asparagus or market garden crops, strawberries, raspberries, corn or pine trees.

Field #2: Same as #1.

Field #3: Garden crops, strawberries (Catskill variety), blueberries in moist sections.

Field #4: Asparagus, garden crops, small fruits, poultry range - portions of this field could be used for pine trees.

Field #5: A good place for the family garden or such crops as cabbage, cauliflower, lettuce. The moisture should help out in dry seasons. It is well to supply irrigation to this soil.

Strong points of this soil type: Drain easily, easy to work, can be plowed early in the season and soil is prevailingly level.

Weak points: In dry seasons soil is apt to be droughty.

Apt to be deficient in organic matter. Soil tends to be acid in natural state. Is not naturally a productive soil.

SOIL TESTING SERVICE LABORATORY

Essex County Agricultural School, Hathorne, Mass.

Report of Analysis of Soil as Submitted to this Laboratory.

Name Farm Address Center Street, Merrimac, Mass.

Sample	pH	Ca	Mg	Al	N	P	K
Upper Field	15.8	Low	Low	Low	Low	Low	Low
Field back of railroad	25.0	Low	Low	Low	Low	Low	Low
Lower section near barn	36.3	Low	Low	Low	Low	Low	Low
Lower sec- tion R.Road field	46.4	Low	Low	Low	Low	Low	Low
Middle section back of railroad field	56.4	Low	Low	Low	Low	Low	Low

Tested by A. G. Perkins

The soils seem to be worn out as indicated by the soil tests. It would take a few years before these fields could be built up for successful production. In the case of all fields lime is needed depending on type of crops to be grown. From one to two tons per acre will be needed. A heavy manuring would help this sandy soil and 1000 pounds of a 5-10-10 fertilizer should be applied per acre for most crops.

Another type of service call is one that involved a young man who had inherited a large farm in Newbury, Massachusetts. He wanted to make a dairy farm out of it although the soil was not an ideal dairy soil. Some of the crops such as alfalfa were not doing too well. After talking it over in a conference at the school the author decided to make a visit to the farm to get first hand information about the soils, location and the crops that were growing in the different fields. A trip was made over the farm in company with the young man. The problems were discussed, notes were taken, a soil survey was made and a number of soil samples were taken. After testing the samples in the laboratory an analysis was made by the author of the various things involved in the problem and a detailed report was sent the young man. With this instruction he was to reorganize his farm and set-up a plan for improving his soils and adapting his crops.

An example of this report is set-up here to illustrate how such a problem was handled by the author.

Report of Survey on Newbury Farm

The soil type found on this farm is largely Merrimac loamy soil with smaller portions of Hinckley loamy sand, Gloucester stony fine sandy loam muck.

The Merrimac loamy sand is not important agriculturally but with careful management and the use of a great deal of organic matter it can be made to produce

fair crops. It is usually acid and should be limed for the best results. This soil is adapted for alfalfa if it is limed heavily and a liberal quantity of organic matter and fertilizer especially phosphorous and potash are used. Grass would not give large yields except in the muck areas so the legumes or roughage crops such as rye, oats, millets and sudan grass should provide satisfactory feed. Rye vetch should do especially well on this soil. By fertilizing your muck areas and growing more legumes supplemented by such crops as corn, rye, millet and sudan grass you should be able to provide much of the feed for your stock.

Merrimac loamy sand is particularly adapted for light market garden crops, asparagus, brier berries and small fruits. Sweet corn and potatoes and squash might give fair returns if fertilized properly and liberal quantities of organic matter is used.

This soil is especially adapted for poultry. The possibility of combining poultry and dairying should be considered as one possible set-up for this farm.

Much of this farm is now in forest and that should be encouraged on this soil type. Good forest practises would increase the yield of this valuable product and provide an excellent source of income for years to come.

The lime and fertilizer practises for the different fields are suggested in the report on page 52.

Soil Test Report

- #1 On the alfalfa field I would suggest an application of a ton of lime per acre this fall. After the first cutting apply 500 lbs. of 20% superphosphate and 200 lbs. of muriate of potash 60%.
- #2 The hay field is not worth fertilizing. It should be reseeded or planted to a crop and sown down to alfalfa in August. If alfalfa is used it should have an application of $1\frac{1}{2}$ tons of ground limestone per acre, 8 - 10 tons of manure if possible and 600 lbs. of 20% superphosphate and 300 lbs. of muriate of potash 50%.
- #3 The same thing would apply to this plot if alfalfa is used.
- #4 If this field is to be used for corn I would use 500 lbs. of 8-24-8 fertilizer per acre. A ton of ground limestone per acre would also help.
- #5 This field could be limed this fall with a ton of ground limestone per acre. It could be done now if you can do it right away, preferably before a rain. It should help to produce a better turf and encourage more clover to come in. Next spring top dress the whole piece with 350 lbs. of a 10-10-10 fertilizer per acre.
- #6 Do the same as suggested for #5.
- #7 Apply 1 ton of lime per acre after crop is harvested

or this fall. Fertilizer will depend on what is to be used for in the future.

- #8 For grass I would apply $1\frac{1}{4}$ tons of ground limestone per acre this spring or next fall and fertilize next spring with 350 lbs. of a 10-10-10 fertilizer per acre if you want to increase the hay yield. Alfalfa should grow in this area.
- #9 Apply 1 ton of ground limestone per acre. The fertilizer application will depend on the crops to be grown. For potatoes I would use 1600 lbs. of a 5-10-10 fertilizer per acre and do not use lime.

A service call does not always mean that the person appears at the school. Many times a letter is received asking for help with a certain problem. The following letter is a reply to a request from an individual seeking advice on the culture of herbs. In order to give proper instruction it is necessary at times to set-up a rather detailed letter giving implicit directions.

A sample of such a letter is set-up on page 54.

Essex County Agricultural School

Hathorne, Mass.

May 19, 1948

Dear Mrs. _____:

It is true there is not very much material on the culture of herbs. For most of the herbs a warm sunny spot with good drainage is best. The soil does not have to be particularly fertile because a rich soil will produce more luxuriant foliage but with a loss of aroma from the leaves. Some of the mints require a moist soil. The following is a list of some helpful things concerning some of the herbs that can be used for private or commercial purposes.

Name of herb	Average Height	Soil type	Exposure
Anise	18"	light, well drained	sunny
Balm, lemon	24"	average garden soil	sunny
Basil	24"	ordinary well drained soil	sunny
Borage	24"	light garden soil	sunny
Caraway	24"	dry, clay soil	sunny
Catnip	30"	well drained, moderately rich soil	sunny
Chervil	18"	average garden soil	shade of tall plants
Chive	12"	light garden soil	sunny to partial shade
Coriander	24"	fertile, well drained soil	sunny
Dill	30"	warm, dry, sandy soil	sunny
Fennel	48"	average, garden soil	sunny
Lavender	24"	ordinary garden soil	sunny
Marjoran	18"	average garden soil	sunny
Parsley	12"	average garden soil	sunny to partial shade
Peppermint	36"	prefers heavy moist soil	sunny to partial shade
Rosemary	18"	poor, limy soil	sunny
Sage, garden	24"	well drained soil	sunny
Savory, summer	12"	rich, light soil	sunny
Spearmint	24"	prefers heavy moist soil	sunny to partial shade
Tarragan	24"	warm, dry soil	sunny
Thyme, garden	8"	light, warm soil	sunny

I am enclosing a mimeograph sheet with a list of several references on the back sheet. The government has four bulletins I would suggest that you write for. I am enclosing under separate cover, Drug Plants Under Cultivation, Farmers Bulletin #633, Peppermint and Spearmint as Farm Crops.

I trust this information has been helpful.

Sincerely yours,

Alton G. Perkins
Soils Service Department

CHAPTER VII

STUDENT REACTIONS TO COURSE

CHAPTER VII

STUDENT REACTION TO THE COURSES

Replies to Questionnaires -- A number of questionnaires were sent to students who had completed the short unit course in soils given by the author at the Essex County Agricultural School. The purpose was to find out the students reactions to the soils course so that the writer might determine the value of the course content and type of instruction given to these students. The following information was requested:

1. Scope of project -- the number of acres of farm land or square feet of garden, fruit, etc. Type of crops grown.
2. In what practical ways did the course in soils and fertilizers assist you?
3. Remarks of whatever nature the student desired to make.

Typical replies are listed:

1. Scope of project
Six acres of squash, one acre of potatoes, one acre of peas, one acre of corn, one quarter acre of carrots, and one quarter acre of mixed vegetables.
2. In what practical ways did the soils and fertilizer course assist you?

The course in soils and fertilizers helped me in many ways. It helped me to correct deficiencies in the soil. It helped me to select the proper soil and by testing I was able to plan my fertilizer program properly.

3. Remarks

I believe that the study of soils and soil requirements are the foundation of any farm. With this practical knowledge many disappointments would be avoided. I am convinced that if this knowledge was put into practice successful farming would be the result.

1. Scope of project

In charge of private estate of nine and one half acres including a greenhouse. We raise a general line of vegetables, flower gardens, small fruits. In the greenhouse potted plants, fruits and ornamentals are raised. Other work includes general maintenance of grounds, trees and shrubs.

2. In what practical ways did the soils and fertilizer course assist you?

It gave me the proper knowledge of fertilizers to use on the various crops and flowers. Also, it showed me how to plow and apply fertilizers for best results and I understand how the fertilizer reacts in the soil. We also learned how to rotate crops and how they feed and what elements are most needed by the plants. In the greenhouse it is very necessary to know soil types and type of fertilizers to use.

3. Remarks

A knowledge of the soils and fertilizers is very important to anyone who is interested in agricultural work and without it he is greatly handicapped.

1. Scope of project

Seven acres of farm land, two acres of fruit. We grow almost every kind of vegetable but major in corn, potatoes, and squash. We also have five hundred raspberries, and eleven hundred strawberry plants.

2. In what practical ways did the soils and fertilizer course assist you?

In the first place the course made me soil conscious. I can grow much better crops when my soil is tested so I can use the right kind and the proper amount of fertilizer. We planted winter rye for a cover as soon as our crops were harvested. The soil type, of West Peabody, dries out quickly and by plowing in cover crops it helps to retain the moisture. I used double strength fertilizers for my potatoes, onions, corn, and squash this year and the plants certainly showed it.

3. Remarks

We saved money by using double strength fertilizers as you suggested.

1. Scope of project

Fifty acres of corn, potatoes, squash, and tomatoes.

2. In what practical ways did the soils and fertilizers course assist you?

It enabled me to change a farm that was non-productive to one now in a high state of production.

3. Remarks

The course was invaluable to me.

1. Scope of project

Two and one half acres of vegetables, beans, peas, carrots, beets, peanuts, squash, potatoes, melons, turnips, and lettuce. Twenty-five acres of hay.

2. In what practical ways did the soils and fertilizer course assist you?

It helped us to determine what we could grow most successfully in given areas of our farm of forty acres instead of using the trial and error method.

3. Remarks

We have profited several times by the advice and cooperation of the instructor of this course in dealing with our problems.

1. Scope of project

Eighty acres of hay and pasture land. One acre of orchard. Three acres of market garden.

2. In what practical ways did the soils and fertilizer course assist you?

In determining soil conditions and the best methods of improving soils to produce great yields of field and garden crops. It also helped me to fit crops to available land.

3. Remarks

We felt that we got a lot of valuable information from your course and advice.

1. Scope of project

Ten acres of hayland. Six acres of chicken range.

2. In what practical ways did the soils and fertilizer course assist you?

It helped me to apply fertilizer I needed. I succeeded in cutting down expenses for feed for both dairy cows and chickens. I also learned to better utilize the manure from both the cows and chickens.

3. Remarks

I found a good soil pays dividends in the saving of feed. During the summer of 1941 and 1942 I figured I saved approximately five hundred and fifty dollars by having a good range.

1. Scope of project

I planted one acre of garden including such crops as corn, beets, carrots, beans, tomatoes, peas, squash, and cucumbers. I have ten acres of grass land also.

2. In what practical ways did the soils and fertilizer course assist you?

It helped me to apply the right fertilizers and the correct amount of lime to bring my land up to a maximum yield. For the knowledge I received at the school I have been able to grow the heaviest stand of grass in this vicinity.

3. Remarks

I value the course I took at the school a great deal.

1. Scope of project

Three quarters of an acre of vegetable garden, asparagus, strawberries and raspberries. Thirty-five fruit trees.

2. In what practical ways did the soils and fertilizer course assist you?

The course gave me a better understanding of the need for limeing my soil and the value of humus in the soil. These practises have been carried out two seasons. I found the banding method of fertilization resulted in a much healthier condition in my vegetable garden and resulted in bigger crops. The garden furnished enough canned vegetables to last us through the entire season.

3. Remarks

I have found the school always willing to cooperate with any project I have had and I am indeed grateful for the help received.

1. Scope of project

One half acre of garden and a few fruit trees. I have started to develop a small unused farm of about forty acres.

2. In what practical ways did the soils and fertilizer course assist you?

The course enabled me to properly build up my land by plowing in green manure which it needed badly. By using the soil analysis system I was able to plant my crops to take most advantage of existing conditions and

get good results. I am practicing crop rotation and trying to improve my idle land by planting rye and plowing it under.

3. Remarks

The course was very enjoyable and informative and I believe it will save me from making many mistakes.

1. Scope of project

I have two gardens, one in the backyard and another on the Cabot Farm in Salem. Probably both gardens would be about one quarter acre in size.

2. In what practical ways did the soils and fertilizer course assist you?

I have been interested in gardening a great many years and found that some vegetables would grow better in some soils than others. After taking the course in soils and fertilizers I understand why this is so and I am able to apply the correct fertilizer and find it gives good results.

3. Remarks

I enjoyed the class very much and I believe I received a great many new ideas and new recommendations that will help me to grow better crops.

CHAPTER VIII

CONCLUSION

CHAPTER VIII

CONCLUSIONS

General -- There has been a sizeable amount of data on soils and climate resources published on Essex County during the last twenty-five years. Such a collection of material does not have too much value unless it can be used for information and instruction to a large number of individuals. The author has put a large amount of this data to work in the course of instruction on soils and climate resources at the school. Now, this data has been made available to hundreds of individuals who are receiving instruction from the school each year.

Restatement of the Problem -- The problem as set-up by the author involves the use of data on soil and climate resources of Essex County, Massachusetts in agricultural instruction.

Specific Conclusions --

1. The use of this data has made the soils courses offered at the school more interesting and valuable to the regular students enrolled at the Agricultural School.

2. This material has made students more conscious of the possibilities of carrying on certain types of agriculture in Essex County.

3. The reaction of a number of students taken from questionnaires indicates that the instruction received in soils courses at the school has helped them to improve their soils, make more profits, and has given

them a great deal of satisfaction.

4. It has made the author a more valuable instructor and provided a rich background to help individuals analyze their numerous crop problems.

5. Many individuals have avoided serious losses because of the instruction received before purchasing a farm.

6. In times of depression and war the soils service department at the school has helped farmers and gardeners to produce more crops on a given area of land by instructing the individuals either in groups or privately on methods of increasing their crop yields.

7. The agencies located at the school such as the Extension Service, the Agricultural and Soils Conservation Services, the 4-H Club Agents have received help from the services offered to them by the author on soils and crops.

8. The general public have been given access to specific types of information on the soil and climate resources of Essex County that would otherwise be unavailable to them.

9. Other agricultural schools will have a guide for the organization of similar types of instruction.

10. Farmers have been able to compete more successfully with other sections of the state by increasing their yields and overcoming weather hazards.

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